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ABSTRACT

The council for the Understanding of Technology in Human Affairs (CUTHA) is a broad-based educational group whose purpose is to promote the understanding of technology and its relationships to society. Provided in this document is a summary of CUTHA's third curriculum workshop which focused on technology for the liberal arts student. The major purpose of the workshop was to present various methods for including technological awareness and literacy within the liberal arts curriculum. Also provided are summaries of four mini-workshops which focused on technology and history/literature, technology and art/humanities, technology and the physical sciences, and administrative/curricular concerns. (These mini-workshop summaries constitute the major portion of this document.) Various concerns, curricula, strategies, and educational outcomes were addressed and discussed as they related to the subject areas unique to history/literature, art/humanities, and physical sciences mini-workshops. The major discussion is in the administrative/curriculum mini-workshop centered on curriculum content and effective procedures for guiding courses and programs through the course-approving process at various institutions. (JN)

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TECHNOLOGY FOR THE LIBERAL ARTS STUDENT

A WORKSHOP SUMMARY REPORT

Presented by the

COUNCIL FOR THE UNDERSTANDING OF TECHNOLOGY IN HUMAN AFFAIRS

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University of Maryland
College Park, Maryland
June 14-16, 1982

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COUNCIL FOR THE UNDERSTANDING OF TECHNOLOGY IN HUMAN AFFAIRS (CUTHA)

BACKGROUND

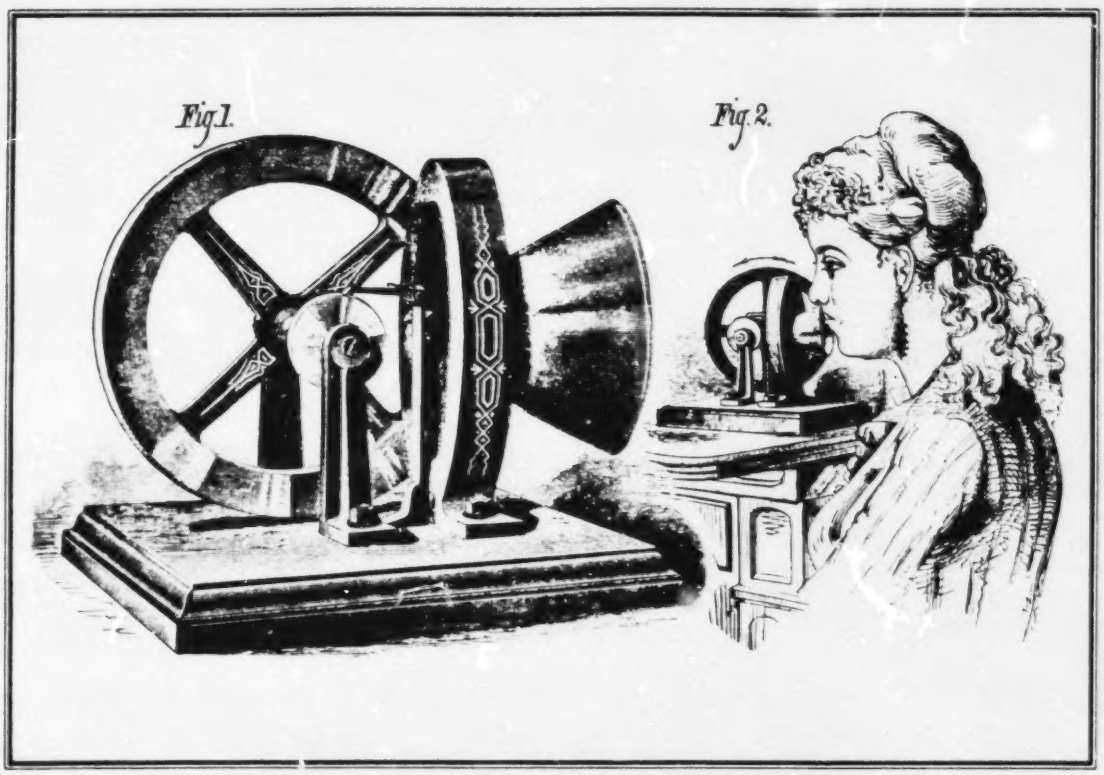
The Council for the Understanding of Technology in Human Affairs (CUTHA) is a broad-based educational group whose purpose is to promote the understanding of technology and its relationships to society. While its initial membership was primarily drawn from colleges and universities, it seeks participation from a wider spectrum of society. Any person or organization concerned with technology in human affairs, such as individuals from industry, labor, government, primary and secondary education, professional associations, is invited to participate in the work of the Council.

The council was organized in June 1979 by a group of representatives from twenty-one colleges and universities in the United States and Canada. This group was drawn together at the University of Wisconsin in Madison by mutual concern for the promotion of technological literacy. CUTHA was incorporated in the state of New Jersey in June 1980.

CUTHA sponsored its first Curriculm Workshop for Liberal Arts faculty in June 1980 at M.I.T. in Cambridge, MA. In June 1981 a similar workshop was held at Chatham College in Pittsburgh, PA.

PURPOSE

Technology has become a fundamental factor in human affairs and in public policy, and has influenced our physical and social environment with its products. A concomitant development of technological concepts, modeling techniques and problem-solving modes, themselves relevant to myriad fields of endeavor, constitutes an important contribution to liberal education and should therefore be made available to a wider segment of society. The need for better public understanding of the role of technology in society, as well as the history of technology in human affairs, continues to grow. While science is given much attention in the media and in secondary and higher education, technology has been neglected. CUTHA sees the need to encourage greater attention to the role of technology in human affairs.



EDISON'S VOICE ACTIVATED PHONOMETER MACHINE

SUMMARY REPORT

Curriculum Workshop: Technology for the Liberal Arts Student
Sponsored by the Council for the Understanding of Technology in Human Affairs

June 14-16, 1982 — University of Maryland, College Park, MD.

The Council for the Understanding of Technology in Human Affairs (CUTHA) sponsored its third annual workshop on Technology for the Liberal Arts Students at the University of Maryland in College Park on June 14-16, 1982. The workshop was supported by the A.T.&T., Exxon and U.S. Steel Foundations.

The curriculum workshop, primarily for participants from the mid-Atlantic states, was attended by over 120 participants from 20 states, the District of Columbia and Canada. The program was organized by Dr. J.Paul Hartman from the University of Central Florida. Dr. Richard H. McCuen was in charge of facilities and accommodations for the host institution.

After welcoming remarks by the University of Maryland Chancellor Robert Gluckstern and by Dean George Dieter from the College of Engineering, Dr. Edward Friedman, Chairman of the CUTHA Board of Directors explained the background and purposes of the organization. Dr. Hartman followed with a discussion of "Literacy, Numeracy and Technolacy," and the workshop purpose: to present various methods for including technolcgical awareness and literacy within the liberal arts curriculum. Noting the national concern over declining American leadership in world engineering and technology and admitting the difficulty of defining a "liberal education," he requested the participants to consider what has been done and what might be done within their own institutions. CUTHA'S primary goal is to increase the awareness of the importance of engineering and technology in contemporary civilization and to close the widening gap between what C.P. Snow has referred to as the "two cultures."

There were four major presentations on the afternoon of the first day. Miles Orville from Temple University summarized the variety of themes developed in his course in Technology and American Culture including technology and work, the consumer, politics and democracy. Julie Wosk from SUNY-Maritime highlighted aspects of her own course on Art and Technology, which deals not only with technology in art and art in industry, but also with artistic responses to technology. Merritt Roe Smith from M.I.T. then reviewed various history of technology course syllabi from several institutions. Course topics included Technology in History, Technology in American History, and the Machine Metaphor, Fact and Theory. John Truxal gave the fourth presentation describing the popular courses in Technology and Society at SUNY-Stony Brook, with details about his particular course in modern electronic communications.

In an evening session Barrett Hazeltine discussed two courses at Brown University for non-engineering majors, one in Electronic Circuits and Applications and the other in Intermediate Technology. David Billington from Princeton University then gave a slide presentation illustrating selected topics from his coursework dealing with structures and the urban environment.

Tuesday morning started with a general panel session about various ways institutions are including technological literacy within their programs. Panelists included Gershon Vincow (Syracuse University), Bernie Steckler (Seattle University), James Murphy (Iona College), and Carol Donley (Hiram College).

Later there were four mini-workshops on History/Literature, Art/Humanities, Physical Sciences and Administration/Curricula. Each participant could attend two of the mini-workshops. Mini-workshop reports constitute the major portion of this summary.

The two general afternoon sessions on Tuesday covered topics of complementary interest to CUTHA. The first session discussed programs on Science, Technology and Society (STS). Some programs deal primarily with social impact, with little attention to the actual technologies, while others include large technological components. Shirley Malcom, from AAAS, moderated this discussion and panelists were Stephen Cutliffe (Lehigh University), Jim Adams (Stanford University), Leon Trilling (M.I.T.), Bob Wheeler (Yale University) and John Truxal (SUNY-Stony Brook). A second session moderated by Jack Geils (AT&T), discussed concerns of industry and government, and included panelists Bud Morgan from the Chesapeake and Potomac Telephone Co. and John Andelin from the Office of Technology Assessment (OTA).

On Wednesday morning participants gathered for the final general session on implementation strategies and tactics. Conference participants joined in a lively discussion of the following implementation procedures, suggested by the moderator, Gershon Vincow, from Syracuse University:

(1) Clarify the particular reasons why it is important to introduce "technological literacy" to your campus;

(2) Decide which aspect(s) of technological literacy you will focus on (e.g., technology and the humanities, social impact of science and technology, principles of engineering, specific branches of engineering/technology);

(3) Decide on a program outline or type (ranging from one course to a structured program, elective or required course(s), self-contained course or courses based on a science and/or mathematics prerequisite);

(4) Spend considerable time educating and motivating faculty and administrators concerning the importance of technological literacy so as to facilitate faculty approval and institutional support;

(5) Consider the resources needed to develop course

(extramural grants, institutional support including faculty released time, human resources including engineering, and/or science and mathematics faculty, industrial linkages, humanities and social science faculty).

(6) Develop the curriculum (establish goals, solicit materials, from a variety of sources including CUTHA, Lehigh University STS Newsletter, SUNY Stony Brook program, attempt to include "learning by doing" and palliate student anxiety with lively demonstrations and interesting class exercises).

Conference adjournment followed at 11:00 a.m. On a brief evaluation form, conferees rated the overall conference very high (4.2 on a scale of 5) while individual sessions or presentations ranged from 2.5 to 4.8.

J.P. Hartman
November 1982

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MINI-WORKSHOP SUMMARY:
Technology and History/Literature — I

Chairs: Miles Orvell, Temple University
Merritt Roe Smith, M.I.T.

Recorder: John MacDougall, University of Lowell

Most of the issues raised were both substantive and pedagogical. Miles Orvell and Roe Smith expressed concern about the level at which technology should be approached. Both agreed that they teach courses about but not in technology. The objective is cultural and political competence rather than technological literacy. Orvell spends much time in his course on cultural and value issues — though he finds many students learn what they need about technologies, and go into technological detail in their research papers. Smith stressed that the way literature or history is used depends upon the context. For instance, he precedes an analysis of *The Great Gatsby* with material on the automobile and on manufacturing techniques. Orvell teaches literature not as a form but as a way of knowing and a source of evidence.

The question was raised of how then can people deal with value issues. Both workshop leaders emphasized that they do not often use the word "value." Rather, Roe Smith covers value questions through a multi-case approach. For example, in his examination of the values and culture of early industrial communities, he looks at metalworking communities around the Springfield (Mass.) armory, and at the different reactions to the armory by workers and managers. This demonstrates how different groups of people can have different values, even though they all belong to the same culture (this point is nicely spelled out in John Kasson, *Civilizing the Machine*). Miles Orvell frequently refers to ideology, and Roe Smith remarked that ideologies are messy, but interesting. Using the example of the US Navy and its attitude towards applications of radio telegraphy, Smith illustrated possible tensions between groups, and values and their power positions.

The question that aroused most interest came up at the end: how can we control and guide technologies so they serve human interests? Miles Orvell emphasized that in practice, the control of technologies took place through a political process. To avoid a sense of hopelessness at this insight, students should be shown cases where decisions successfully served human interests (for example, in Dorothy Nelkin's comparative studies of nuclear energy policy). Members of the audence suggested that poets help us anticipate future technological discoveries; that according to some observers, science fiction writers increased popular acceptance of technologies; and that some essayists (such as Marshall McLuhan and Susan Sontag) showed us how our sensibilities about a technological world could be ordered. Orvell encourages students to avoid the assumption often attributed to engineers that technology "just happens" to us.

A major concern was whether technologists could be resource people for STS courses taught by humanists

Smith said this worked well for him when he carefully explained beforehand to the visiting engineer the information needed.

MINI-WORKSHOP SUMMARY:
Technology and History/Literature — II

Chairs: Miles Orvell, Temple University
Merritt Roe Smith, M.I.T.

Recorder: Stephen Cutcliffe, Lehigh University

The discussion in the history and literature workshop session focused on general STS concerns, as well as historical and literary perspectives on technology studies. In both cases, however, the questions were largely of a very practical how-to nature.

(1) How can the faculty of a large institution be made more aware of an STS Program or activities? Suggestions included making copies of course syllabi available to potentially interested faculty, holding small colloquium type luncheon or dinner meetings, developing a campus newsletter where funds are available, and, of most value, making personal contacts.

(2) How can mutual respect among engineerng and liberal arts faculty be increased? Presumably, activities as noted above would increase respect which would then be transmitted to students in the classroom and through the advising system.

(3) How can enginers interested in history, literature and technology work in those fields and earn the respect of professional historians and literary scholars? Merritt Roe Smith suggested that developing mutual interaction through meetings and working cooperatively would be imporant. He noted in particular the mixed membership of the Society for the History of Technology and stressed its importance as a facilitating organization.

(4) How deeply should literature and history courses be *in* technology rather than about technology? Both Roe Smith and Miles Orvell agreed that there was no magic formula. The key may be in the *relevance* of this technical material. Orvell noted that he frequently uses case studies and offered early nineteenth-century Lowell textile developments as an example. Smith emphasizes major sectors of change such as textiles, interchangeable parts, machine tools, and steam power. Technical detail can reveal aspects of the broader society such as the speed, scale and complexity with which things are done. In teaching about technology it is important not to be intimidated by the material, and in this vein, it is frequently helpful to see things in operation. Ultimately, however, the main focus of humanities and social science courses ought to be on social and cultural issues, including the impact that societal values have upon the development of technology.

Roe Smith noted that the value of history is not to predict the future but to prepare people to deal with similar situations today and perhaps to suggest questions that might otherwise go unasked. He offered as an example a comparison of the impact that the development of interchangeable parts had on the workplace in the past and the possible impact of computer aided manufacturing today. Miles Orvell noted that history demonstrated how social uses of technology derive from specific economic and political forces and that class interests have been (and continue to be) at stake in technological choices.

WORLD'S LARGEST FERRIS WHEEL

MINI-WORKSHOP SUMMARY:
Technology and Art/Humanities

Chairs: David Billington, Princeton University
Julie Wosk, SUNY-Maritime

Recorder: Carol Landis, EDUCOM

Teaching an understanding of technology in art and the humanities is a dual task. On the one hand, we must teach an appreciation and understanding of the technology to liberal arts students. On the other hand we must develop a sensitivity to the artistic and an understanding of the social impact (as viewed through art) of technology to technical students. Discussing first the instruction of liberal arts students, the group focused on Professor Billington's course on Structures. The goals of this particular course are to provide first, a thorough understanding of quantitative measures of structures. The tools provided to the students to undertake this analysis include formulas for stress analysis and various measurement techniques. The second goal is to understand the social impact and processes related to the design and implementation of a structure. The criteria for an analysis here include cost and use. A third and final goal is to understand the symbolic meaning of the structure. Here the criteria include comparative analyses focusing on aesthetic qualities. The students enrolled in the structures course are divided approximately evenly between engineering students, architecture students, (who are more similar to liberal arts students than to engineers), and liberal arts students.

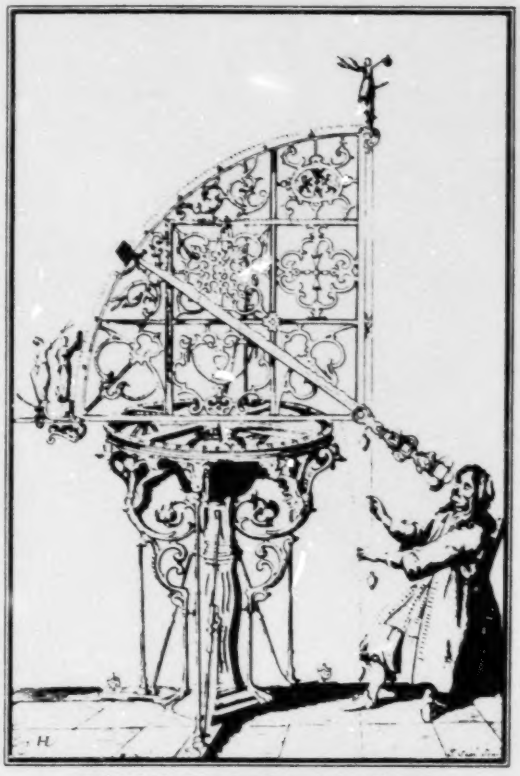
In a course where some of the students are studying architecture, the difference between architecture and engineering becomes relevant. Professor Billington characterizes the differences as: 1) scale, in which the larger scale tends to require engineering more than architectural skills, 2) use, in which a structure built for a single use (such as a bridge) is considered an engineering structure, whereas a multi use structure like a building is an architectural project; and 3) visualization, in which the architect visualizes forms as controlling space and the engineer visualizes forms as contracting forces.

Encouraging artistic sensitivity in technical students is the other side of teaching technology is arts and humanities. In a course on technology and art, Professor Wosk explores the social impact of technology through observation of artistic response. Students examine paintings and sculpture commenting on technology and also discuss other areas where art and technology join forces including industrial design, architecture, video art, and sculpture using motors and modern technological materials.

Because visual vocabulary is often new to both liberal arts and technical students, the class spends several weeks being introduced to visual elements and discussing the nature of modern structural methods and materials newly available to artists. Media used in the course include not only slides but also poetry and novels that relate to the social impact of technology.

For both types of courses, resources are available to faculty from other colleges and universities who have little background in either engineering or art, but who wish to incorporate elements of these fields into their own work. Publications authored by these professors and others chosen by them are listed on the bibliographies distributed at the conference. Most are available from Professors Billington and Wosk.

In summary, the ultimate result of incorporating an appreciation of, and limited practice in, technology into art and humanities courses is the development in all students of verbal, visual, and quantitative vocabularies that allow them to understand and assess the impact of technology in a different way after the courses are completed.



THE QUADRANT OF HELVELIUS

MINI-WORKSHOP SUMMARY:
Technology and The Physical Sciences - I

Chairs: Barrett Hazeltine, Brown University
John Truxal, SUNY-Stony Brook

Recorder: John Sevier, Indiana University at South Bend

The chairs were engineers who had previously made presentations in plenary sessions about courses in engineering for liberal arts students. The workshop participants were mostly scientists and mathematicians concerned about including technological literacy within their own curricula. Two kinds of questions were addressed in the session: first, the general issue of defining the engineering way of thinking and, second, more specific, practical queries about program and pedagogy, curricula, and courses and turf.

Trying to define the engineering outlook consumed most of our time. We assumed that technological literacy is somehow embedded in what engineers do and how they think. Yet it is not a simple task to identify the essence of engineering. As many of us came to realize later in the conference, discussions of such matters function best as phases of an on-going discourse about central things, leading to increased and increasingly shared understandings. Even if it is not appropriate to try to define the whole, however; it is useful to identify and talk about features of this whole. This is what happened in our session.

Another point taken up was that engineering is pragmatic, and that is outlook reflects a spirit of 'can do,' of synthesis, and practical resolution. Engineers are driven, someone said, to practical solutions to the problems they address. They want to get something that works. In addition, that something must be concrete and tangible. Engineers produce artifacts to embody their achievements.

Successive approximation often is used to solve a given problem. In this sense, the strategy is reflected in the tendency for engineering equations to be polynomials in which a basic formula is augmented with a sequence of empirically-derived "fudge" factors. Engineers characteristically set aside complexities by cramming them into such correction factors. They are also inclined to separate aspects of problems, suspending work and judgment on one while wrestling with another that appears more immediately tractable.

The strategy of successive approximation can be seen in sequences of completed products. Families of computers are good examples. Each subsequent member of the family improves upon its predecessor and is a closer approximation to the highest ideal that the family can achieve.

Sequences of artifacts of this kind embody a significant portion of the tradition of engineering. Trilling suggested that engineering also has a *learned* tradition, expressed in written documents and relatively abstract, general formulations. We touched on the traditions of engineering, in our discussion, and we might have moved further had we had Trilling's conception to think with. Without Trilling's contribution we simply concluded that engineering was more like business administration than law, more like medicine than science, at least in the sense that pragmatic orientation tends to reduce (but not eliminate) the constraining power of traditions.

Two other related aspects of the engineering way of thinking were important in our discussions, namely, modelling and quantification. Engineers regularly start with ill-defined and extremely complex problems (which are, incidentally, more likely to be given to them by society than to grow out of a tradition of work as they do in scientific pursuits). Typically engineers begin their work by making 'intuitive' simplifying assumptions that allow them to build a relatively simple model of the problem situation. Work then proceeds on the model and it is refined and improved in a process that is very much like that of successive approximation. Eventually, this work on, and with, models leads to an adequate solution. Finally, these solutions must be in some sense "unmodelled" and transformed into workable responses to the initial problem in all its complexity.

The process of quantification (and "de-quantification") is similar. Engineers tyically need to "get numbers on the board" - not only to develop a sense of scale and magnitude but also to move into a symbolic medium wherein playful analysis is possible. By translating the objects of concern into quantitites, one can work through and test out ideas, can make easy comparisons, and juxtapositions, and can measure the effectiveness of models and their refinements. Engineering quantification is an approximate and pragmatic art, and orders of magnitude are sometimes more useful than precision. Liberal arts students (and other non-engineers) often find this bothersome. As with modeling, engineering quantificationmust ultimately be undone to permit the expression of solutions as practical and fruitful responses to real situations.

Practical concerns in our group led to brief discussions of the following topics:

(1) the half-lives of examples in engineering courses for liberal arts students; these half-lives are short - such courses need continual updating because of rapid technological changes.

(2) The challenge of and widespread need for faculty development with regard to technological literacy: there are few practical solutions yet developed for this problem; and

(3) the packed-curriculum problem - i.e., how can we fit in another new requirement? Especially in mathematics and the physical sciences, the most direct solution is to interweave technological concerns into existing courses; a more thorough-going response would probably entail the development of interdisciplinary (or even contradisciplinary) courses.

MINI-WORKSHOP SUMMARY:
Technology and The Physical Sciences - II

Chairs: Barrett Hazeltine, Brown University
John Truxal, SUNY-Stony Brook

Recorder: Lawrence L. Garber, Indiana University at South Bend

At the beginning of the workshop individuals introduced themselves and gave reasons for attending this conference. Several have established courses or curricula in STS, while others were attending in order to acquire new ideas concerning curriculum and course development.

One of the first comments was that broadly educated students need to be exposed to practical aspects of learning in addition to formal, prescriptive and descriptive aspects. Current methods of teaching chemistry and physics no longer discuss practical examples, but tend to be more fundamentally oriented. A responder suggested that these fields have become more complex, and thus, there is insufficient time to discuss the various practical examples. Another participant felt that this omission was not necessarily wrong because engineers who have a stronger fundamental background would be able to advance more rapidly and adapt to technological change more easily. Thus, basic science courses should be more theoretical.

Professor Truxal suggested that courses in STS should include how to identify a problem, construct a quantitative model for the problem (decision trees for example), and refine the model. This activity would provide a series of options, or in some cases would provide an optimum. Another participant suggested that any course that teaches technology must contain some discussion of risk benefit analysis recognizing that not all discussions of risk can be quantified. It was also suggested that a course in technology should include a respect and appreciation for engineering and reasoning. It is important that the quantitative approach to engineering precede a discussion of risk.

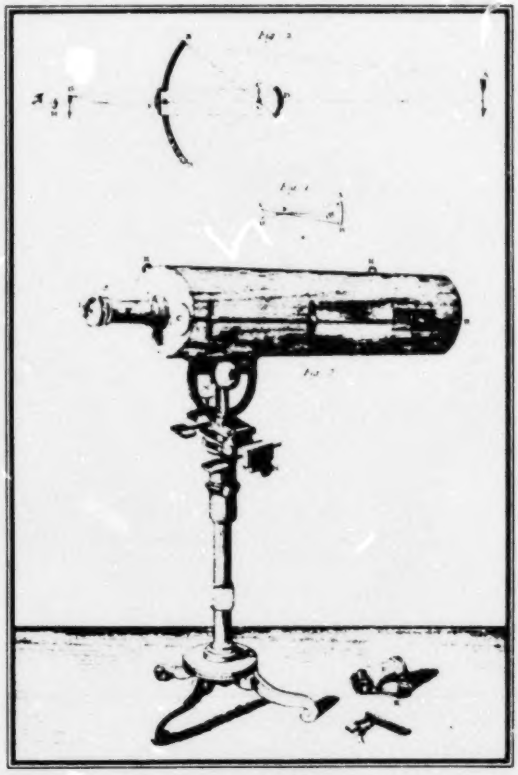
Several questions were raised:

(1) Why do we want students to have a course in technology in the first place? One answer was that such a course assists the student in reasoning and thinking.

(2) How feasible is it for individual faculty to become involved in the modification of courses and curricula? The individual must convince colleagues and the institution of the necessity and validity of such endeavors and be willing to devote a lot of free time to this activity. Innovations often come about due to the efforts of two or three individuals, but to be enduring, institutional support is necessary.

(3) Since the lag time between fundamental discovery and application is becoming very short in certain areas such as biotechnology, how easy is it for those who teach to keep abreast? A biologist responded that most colleges and universities can keep up with and adapt to new developments in technology.

One frustrated participant thought the conference would be more valuable to the non-expert in technology if individual speakers could spend one to two days on a topic, as compared to 45 minutes.



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MINI-WORKSHOP SUMMARY:
Administrative and Curricular Concerns - I

Chair: James P. Murphy, Iona College

Resource People: Carol Donley, Hiram College
Ed Friedman, Stevens Institute of Technology
Bernie Steckler, Seattle University
Gershon Vincow, Syracuse University

Recorder: Russell K. Rickert, West Chester State College

The discussion centered about the earlier descriptions of programs incorporating technology and the liberal arts. Most of the questions that were raised concerned curricular content and effective procedures for guiding courses and programs through the course-approving processes of the institutions.

A series of questions concerned the process of approving courses in technology for liberal arts students. How do institutions approve courses that are not formally assigned

to a department? How do institutions agree upon the structure of a general education program? How are specific general education courses approved? The answers to these questions are institution-specific. Every institution has a procedure by which programs and courses are approved. The technology courses appropriate for liberal arts students are neither a part of an engineering program nor traditionally part of liberal arts programs, and faculties frequently are reluctant to accept them. Usually their approval requires skillful political action by one or two respected professors who are willing to take a risk as well as attract the support of a sympathetic administration. In the long run, the courses will survive only if they become incorporated into the basic curricular structure of the college.

During the earlier presentation, technology courses for liberal arts were described as either interdisciplinary, multidisciplinary, or transdisciplinary. In response to questions about the relative merits of these approaches, Professor Vincow reminded us that there is no single "right" approach. At Syracuse, the program was built upon the strength of the disciplines. Apparently, it is the view of most faculty members that interdisciplinary seminars seem to be ineffective as introductory experiences, but they can serve well as the culmination, after the students have learned enough technology to have "something to integrate." Others still contend however, that the best way to gain student interest and involvement is to begin from the broader viewpoint and then proceed to a more formal and detailed study of technology.

One participant was interested in computer oriented courses as examples of technology for liberal arts students. Professor Friedman recommended that these courses serve best when they present the interactions of computing with society and the approach one takes to thinking through problems when the computer is used to analyze the data. He considers courses dealing with specific computer languages to be a less desirable way to teach liberal arts students about technology.

There was some attempt to define the distinction between courses in technology and courses *about* technology. The distinction is probably based upon the degree of student involvement in problem analysis. To be useful, the course should capture the interest of students enough to motivate them to become involved in problem analysis at least to the point where they understand the impact of *values* in the analytic process. In his panel presentation, Professor Vincow had said, "In sociotechnological problems, the occasions for dispute and disagreement primarily concern judgments about values rather than judgments about facts." Because involvement in the analysis is essential, courses in technology cannot be successfully offered without using at least high school algebra, but calculus is not essential.

In practice, must technology courses be required of students or can they succeed as electives? If courses are selected on a "free market" basis, they must be attractively advertised. Courses responding to student motivations are more likely to succeed; and students often care more about future careers than about a broad education.

In summary, persons wishing to establish courses in technology for liberal arts students would do well to gain the cooperation of one or more colleagues, prepare a course attractive to students, and adroitly use the campus politics to gain approval and acceptance of such courses.

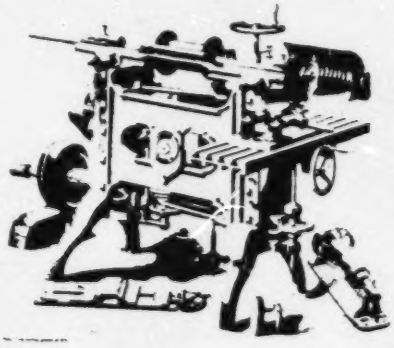
MINI-WORKSHOP SUMMARY:
Administrative and Curricular Concerns - II

Chair:	James J. Murphy, Iona College
Resource People:	Carol Donley, Hiram College Ed Friedman, Stevens Institute of Technology Bernie Steckler, Seattle University Gershon Vincow, Syracuse University
Recorder:	Carolyn Keefe, West Chester State College

Participants discussed several questions troubling them and sought responses from those who already embarked upon programs.

(1) To what extent are engineering professors involved in curriculum development for liberal arts students? Steckler reported that at Seattle University three engineering professors are involved in the program. Murphy suggested where no school of engineering exists, engineers are sometimes in departments such as computer science, or business, physics, chemistry, biology or statistics. Schools could appoint engineers as adjuncts.

(2) What can be done to get institutions to accept innovative programs? Vincow pointed out that most faculty members find it terrifying to teach outside a particular discipline. He encouraged socialization of the faculty. Their anti-technological ideas must be allowed to surface, and

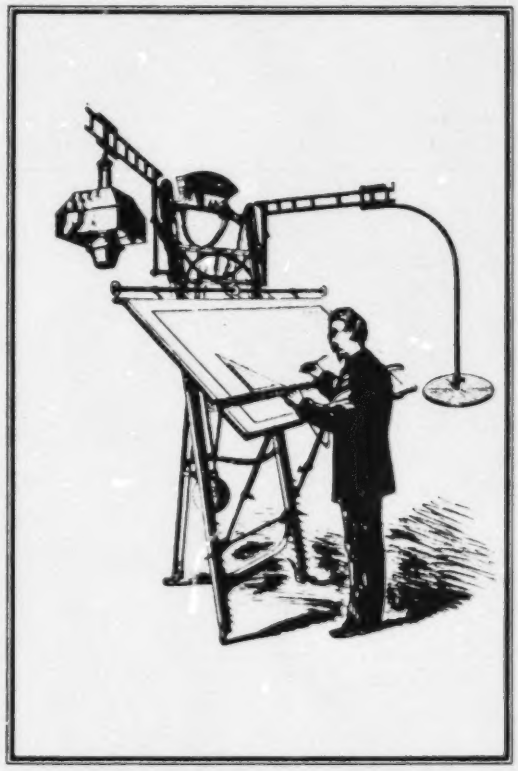


someone able to deal with them must be on hand. Interdisciplinary thinking and cooperating must take place. The panelists agreed that getting faculty members to think in interdisciplinary terms is frustrating work. Mutual respect is the key. Field trips for the faculty to see high technology in action have been used successfully, by some. Friedman claimed that schools have potential for this type of curriculum development but cautioned that the structure should be planned carefully. Donley assured the group that it is easier the second time around.

(3) What grant money is available for curriculum development? Donley reported that her school had $25,000 for three years to train faculty in computer usage. Murphy said that initially his school did not have special funds but later had four sources: i) $17,000 from the president's discretionary fund, ii) faculty development money, iii) $200,000 from IBM, and iv) a grant of $100,000 from the trustees' foundation (for students taking the courses).

(4) Have interdisciplinary courses attracted students? Donley said that although computer science has higher enrollments, the internships provided by the new programs are a drawing card. A delegate reported about a successful course based on a mathematical model at her small liberal arts college.

(5) What resources are available for this type of interdisciplinary curriculum development? Friedman responded that an engineer at Lehigh University is developing materials with a computer-based analysis. Also, Gerry Nadler at the University of Wisconsin-Madison is working on course modeling. Friedman reported that lists and compendia are available from Research in Science Education (RISE), Development in Science (DISE), and Ethics and Values in Science and Technology (EVIST). Murphy expressed the need for distilling information regarding curriculum development. Someone, he felt, has to respond to this need. Maybe CUTHA?



UNIVERSAL DRAWING STATION

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